How Productive are the Soils of Central Illinois?

By R. T. Odell

Bulletin 522
University of Illinois
Agricultural Experiment Station

CONTENTS

Urbana, Illinois March, 1947

Publications in the Bulletin series report the results of investigations made or sponsored by the Experiment Station

HOW PRODUCTIVE ARE THE SOILS OF CENTRAL ILLINOIS?

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HOW do crop yields on my farm compare with those on other farms having the same soil type? What crop yields are obtained under good soil management on farms having soils similar to those on my farm? What can I do to get better yields? These are examples of questions that farmers thruout Illinois have been asking.

Other inquiries come to this Station from people wanting to buy land. A man writes: "I am planning to buy a tract of land and have been offered one on Tama silt loam and one on Drummer clay loam. What crop yields can I expect on these two soil types under fair management and also under good management?"

Prospective buyers of land in central and northeastern Illinois often want to know how much the impervious glacial till underlying Clarence silt loam and Rowe clay loam to clay limits crop yields.

These and many similar questions can be answered only by figures showing what crop yields are being obtained on various kinds of soil when managed in different ways. This publication presents a summary of yields which farmers have obtained during the twenty years from 1925 thru 1944 on some important soil types in central Illinois. Crop yields obtained on four of the University's soil experiment fields are also included for comparison.

Long-Time Farm Records Studied

Since 1938 the Agronomy Department of the University of Illinois has been mapping the soils and collecting records of crop yields and soil-treatment practices on central Illinois farms. Most of the records go back ten to twenty years.

[1] The work reported in this bulletin was initiated by R. S. Smith, Chief in Soil Physics and Soil Survey. Guy D. Smith, formerly Associate in Soil Physics and Soil Survey, did the first year's work on the problem in 1938, and the author has continued the study since that time.

Some of the records which form the basis for this study have been kept by farmers in cooperation with the Department of Agricultural Economics of the University of Illinois; some have been kept by fieldmen and farm managers for life-insurance companies and large private estates; and some have been kept by farmers for their own use.[1]

Altogether the records from 551 farms scattered over 41 counties have been examined. Some of these farms were omitted from the final study because their records were incomplete. Others were dropped because the soils in the different fields were too variable. To be included in this study, a field had to fit into one of three classifications. If as much as 90 percent of the area was of a single soil type and the rest was a closely related type of similar productivity, the field was considered a single type. If a field was made up of 40 to 60 percent of each of two associated types or of 25 to 40 percent of each of three associated types, it was listed as being composed of associated types. Fields which included two or more soil types that did not occur in the proportions indicated were omitted from this study.

From the 551 farms, records for 444 tracts have been brought together in Table 1. "Tract" is used here to indicate an area made up of one or more fields on a single farm — sometimes the entire farm. All the fields in a tract had to be uniform enough in soil type to fit into one of the classifications described in the preceding paragraph. Management practices, such as soil treatment and cropping systems, also had to be similar on all fields that were included in a single tract.

The tracts are grouped in Table 1 according to both soil type and soil management. These are the two important factors influencing crop yields, aside from climate and the adaptation of a crop to the conditions under which it is produced. The number of tracts in each soil-type and soil-management group gives some idea of the reliability of the averages.

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[1] Acknowledgment is due to the Department of Agricultural Economics of the University of Illinois and to the farmers and others who have kept the records used in this study for their generous cooperation.

Table 1.—CROP YIELDS OBTAINED ON DIFFERENT SOIL TYPES UNDER GOOD, FAIR, AND POOR MANAGEMENT:

444 Farm Tracts on the More Important Soil Types and Associations in Central Illinois

(1925 to 1944 inclusive)

Region (see Fig. 1)	Soil type or association of soil types (name and No.)	Soil management systems	Number of tracts[b]	Average yields per acre of various crops[a]: Hybrid corn[c] 1937-1944	Open-pollinated corn[c] 1925-1936	Soybeans 1925-1944	Oats 1925-1944	Spring barley 1925-1944	Winter wheat 1925-1944	Alfalfa hay[d] 1925-1944	Red clover hay 1925-1944	Percent of cultivated land in various crops: Harvested for grain: Corn	Soybeans	Total small grain	Used for hay, pasture, or soil improvement: Nonlegume	Legume or mixed	Average percent[e] of cultivated land treated with—: Limestone	Rock phosphate
				bu.	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*tons*	*tons*	%	%	%	%	%	%	%
1a, 1b	Clinton silt loam (18)	Good	9	64	41	24	37	..	23	2.2	...	30	5	29	4	32	92	50
		Fair	12	59	38	20	34	..	19	...	...	21	9	28	7	34	54	5
1a, 1b	Tama silt loam (36)	Good	14	68	48	24	42	..	22	2.6	1.4	40	3	23	4	30	78	23
1a, 1b	Muscatine silt loam (41)	Good	10	75	50	..	49	..	23	2.4	...	45	2	24	2	26	69	37
1b	Sable silty clay (68)	Good	8	68	53	28	44	..	..	2.0	...	53	6	24	2	15	22	30
1a, 1b	Tama silt loam and Muscatine silt loam associated (36-41)	Good	12	69	49	21	44	34	28	2.5	...	40	5	25	3	27	73	35
		Fair	2	63	42	20	37	..	23	...	...	46	7	28	4	15	36	0
1a, 1b	Tama silt loam, Muscatine silt loam, and Sable silt clay associated (36-41-68)	Good	11	74	50	26	45	31	..	2.8	...	44	6	23	2	24	58	20
1a, 1b	Muscatine silt loam and Sable silty clay associated (41-68)	Good	47	75	53	27	47	32	25	2.5	1.5	44	8	23	1	23	56	31
		Fair	14	69	48	26	43	..	24	...	1.4	45	12	25	2	15	15	20
		Poor	2	..	44	..	38	..	..	...	...	49	4	39	0	4	0	4
1a	Bolivia silt loam and Ipava silt loam associated (246-43)	Good	3	75	47	27	46	..	24	2.6	...	39	4	26	3	28	81	44
		Fair	4	59	40	25	43	..	23	...	1.4	44	9	27	3	17	22	18
1a	Bolivia silt loam and Ipava silty clay associated (246-65)	Fair	5	64	42	23	42	..	21	...	...	43	7	25	6	19	33	3
1c	Bolivia silt loam and Ipava silty clay associated (246-65)	Good	3	72	42	28	42	..	24	...	...	34	18	24	1	22	84	15
		Fair	3	61	37	24	41	..	24	...	...	38	23	24	1	14	51	13
		Poor	2	50	32	19	40	..	..	...	...	45	17	24	3	11	27	0

For footnotes see page 377.

(Table is continued on next page)

Table 1.—CROP YIELDS OBTAINED ON DIFFERENT SOIL TYPES—Continued

Region (see Fig. 1)	Soil type or association of soil types (name and No.)	Soil manage-ment systems	Num-ber of tracts[b]	Average yields per acre of various crops[a]: Hy-brid corn[c] 1937-1944	Open-polli-nated corn[c] 1925-1936	Soy-beans 1925-1944	Oats 1925-1944	Spring barley 1925-1944	Win-ter wheat 1925-1944	Alfalfa hay[d] 1925-1944	Red clover hay 1925-1944	Percent of cultivated land in various crops: Harvested for grain: Corn	Soy-beans	Total small grain	Used for hay, pas-ture, or soil im-provement: Non-leg-ume	Leg-ume or mixed	Average per-cent[a] of cul-tivated land treated with—: Lime-stone	Rock phos-phate
				bu.	bu.	bu.	bu.	bu.	bu.	tons	tons	%	%	%	%	%	%	%
1a	Tovey silt loam and Bolivia silt loam associated (247-246)	Good	5	..	..	27	44	..	..	2.5	...	40	3	17	6	34	64	10
		Fair	4	61	..	22	38	..	20	...	...	40	2	27	3	27	58	14
2a, 2b	Harrison silt loam (127)	Fair	2	55	..	..	35	..	18	...	...	32	8	33	6	21	46	0
2a, 2b	Herrick silt loam and Herrick clay loam associated (46-50)	Good	4	68	..	26	39	..	26	2.6	...	35	25	14	4	22	86	29
		Fair	10	58	37	24	38	..	22	...	1.2	30	24	24	5	15	35	8
2a, 2b	Harrison silt loam and Herrick silt loam associated (127-46)	Good	5	62	..	23	..	..	23	...	...	41	9	23	4	22	81	15
		Fair	5	57	..	23	36	..	21	...	...	31	9	26	11	21	50	6
3	Clarence silt loam and Rowe clay loam to clay associated (147-230)	Good	3	51	..	20	36	..	..	2.4	...	36	19	17	3	25	43	17
		Fair	10	40	24	16	27	..	..	...	...	36	15	25	1	20	25	1
		Poor	5	29	17	11	19	..	..	...	...	38	17	29	3	13	6	0
4	Swygert silt loam to silty clay loam and Bryce clay loam to clay associated (91-235)	Good	12	60	40	21	39	..	22	2.1	...	41	6	28	2	23	54	38
		Fair	6	47	39	19	32	..	..	...	1.2	44	11	24	3	17	12	15
		Poor	2	35	..	16	26	..	..	...	...	44	12	31	3	8	15	0
5, 6, 8a, 8b	Drummer clay loam (152)	Good	12	71	51	..	41	..	25	2.3	1.1	48	4	28	1	19	18	40
		Fair	5	63	45	26	38	..	21	...	...	46	19	23	1	10	3	4
5	Proctor silt loam and Brenton silt loam associated (148-149)	Good	4	67	47	21	49	32	..	...	...	49	4	25	1	21	76	56
5	Proctor silt loam, Brenton silt loam, and Drummer clay loam associated (148-149-152)	Good	8	68	48	21	53	..	..	2.3	1.3	42	6	26	2	23	54	36
5	Brenton silt loam and Drummer clay loam associated (149-152)	Good	15	72	48	24	45	..	27	2.4	1.4	45	6	26	1	22	30	33
		Fair	9	63	44	26	37	..	18	...	1.3	42	12	28	3	15	18	3
6	Catlin silt loam (171)	Good	4	64	44	20	43	..	21	2.2	...	43	8	23	1	24	73	46
		Fair	2	59	41	19	42	..	19	...	...	37	9	26	5	21	16	1

Table 1. — Concluded

				bu.	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*tons*	*tons*	%	%	%	%	%	%	%
6	Flanagan silt loam and Drummer clay loam associated (**154-152**)	Good	13	70	51	26	45	..	21	2.6	1.6	42	12	20	2	24	57	40
		Fair	27	64	45	26	42	..	22	...	1.3	38	22	25	2	13	26	13
		Poor	6	58	39	..	38	..	22	...	...	41	25	26	1	7	7	1
7	Uncorrelated Brown Silt Loam and Black Clay Loam associated; developed from 40-65 inches of loess over calcareous, slowly permeable, silty clay loam till (no official number assigned)	Good	16	68	49	24	44	27	26	2.4	1.6	46	4	28	1	20	67	38
8a	Saybrook silt loam (**145**)	Good	5	72	50	..	57	39	..	2.1	...	38	1	25	4	28	76	37
		Fair	4	64	45	..	44	27	..	...	...	41	7	29	6	16	20	2
8a	Saybrook silt loam, Lisbon silt loam, and Drummer clay loam associated (**145-59-152**)	Good	13	78	51	25	56	36	22	2.3	...	43	3	28	2	23	65	30
		Fair	7	63	41	22	49	31	..	...	1.4	42	7	27	2	21	13	13
8b	Saybrook silt loam, Lisbon silt loam, and Drummer clay loam associated (**145-59-152**)	Good	7	71	49	28	48	..	23	2.3	...	42	10	23	3	22	68	38
		Fair	7	57	42	23	39	..	..	...	...	45	8	26	4	16	38	8
9	Ashkum clay loam to silty clay loam (**232**)	Good	6	64	47	25	42	..	..	2.5	...	44	3	26	1	20	28	37
9	Elliott silt loam and Ashkum clay loam to silty clay loam associated (**146-232**)	Good	20	64	45	23	42	..	25	2.0	...	45	4	28	1	22	58	35
		Fair	13	59	41	21	38	..	20	...	1.0	47	9	28	1	15	14	21
10	Hagener loamy sand (**88**)	Fair	4	43	..	6[f]	..	13[g]	..	...	...	15	9[f]	39	2	30	56	2
		Poor	3	33	..	6[f]	..	..	16	...	...	31	15[f]	37	0	12	16	0

[a] Not every farmer was able to report yields for every crop every year. More records were available for corn and oats than for the other crops, which are grown less regularly. Yields were calculated as follows: First, the yield of each crop was figured for each year for each farm or portion of a farm where soil-management practices and soil types were uniform. For each crop grown five or more years during the ten-to-twenty year period, the long-time average yield for each tract was then calculated. The tracts were then grouped according to soil types, and the soil-type groups were divided according to kind of management. The long-time average yields were then figured for each soil type and for each management group.

[b] The term "tract" refers to a farm or part of a farm (one or more fields) where the soil types and soil management practices were uniform.

[c] The difference between corn yields during 1925-1936 and 1937-1944 is now being studied. About one-third of the difference is due to the introduction of hybrids in the later period; about one-third is due to differences in weather between the two periods; and the rest is due to other factors.

[d] Figures in this column indicate amounts of alfalfa actually harvested for hay. They are, however, less reliable than yields reported for other crops, because alfalfa is often used for both hay and pasture. Farm records did not always show how much of the total alfalfa produced on an area was used for hay and how much for pasture. Most of the reported alfalfa-hay yields are lower than they would have been if all the alfalfa had been harvested for hay.

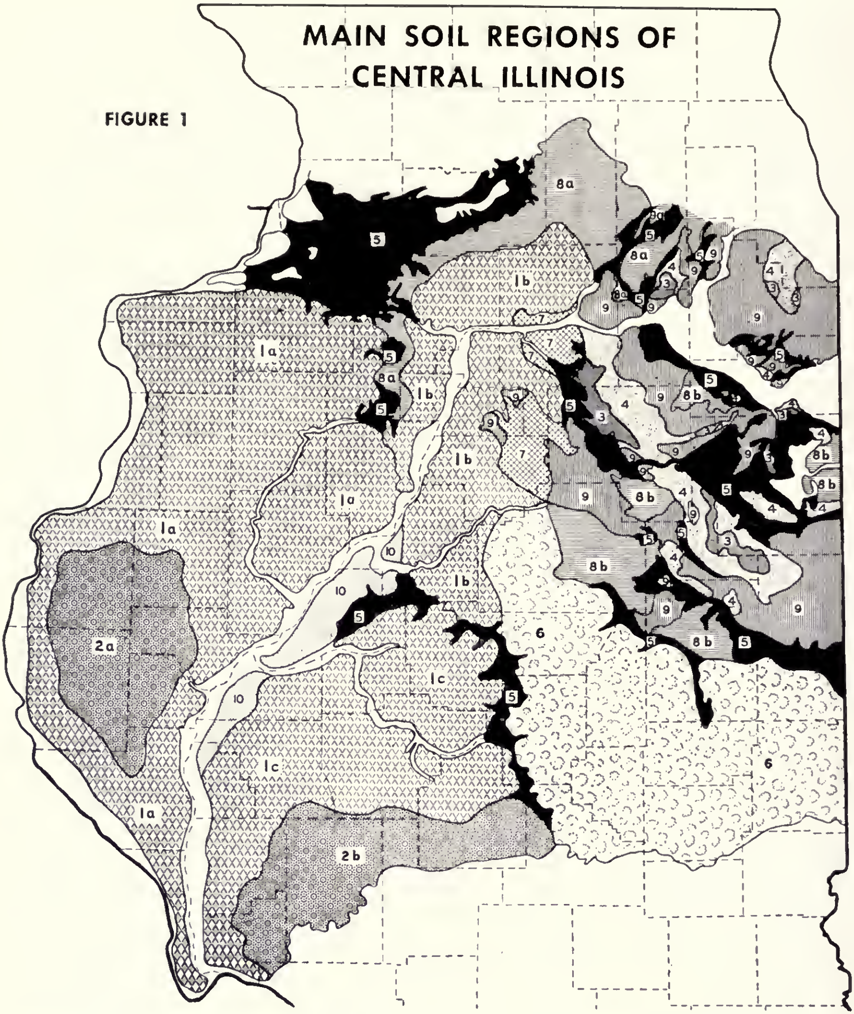
[e] These percentages are averages of the yearly cumulative percentages. See Table 3 for an example of how they are calculated.

[f] Cowpeas instead of soybeans were grown on Hagener loamy sand.

[g] Rye was grown on Hagener loamy sand instead of barley.

MAIN SOIL REGIONS OF CENTRAL ILLINOIS

FIGURE 1



PARENT MATERIALS IN DIFFERENT REGIONS

- 1a, b, c—Loess 70-300 inches thick, calcareous at 40-70 inches
- 2a, b—Loess 50-80 inches thick, generally noncalcareous
- 3—Calcareous, nearly impermeable clay till
- 4—Calcareous, very slowly permeable silty clay till
- 5—Glacial outwash and lake-bed sediments
- 6—Loess 40-75 inches thick over calcareous permeable loam till
- 7—Loess, 40-65 inches, over calcareous, slowly permeable silty clay loam till
- 8a, b—Calcareous permeable loam till
- 9—Calcareous, slowly permeable silty clay loam till
- 10—Predominantly sandy glacial outwash and terrace deposits

Region 1 is divided into three subareas because it is so large and information for some soil types is not complete in every area. Subareas in Regions 2 and 8 are widely separated geographically; the climate in 8a and 8b is different enough to affect yields. For crop yields on soil types in various areas see Table 1, pages 375 to 377.

Characteristics and Location of Soil Types

In central Illinois there are many different kinds of soil, which vary greatly in characteristics and productivity. Most of them, however, are very productive, especially for grain crops like corn. Level to gently sloping dark prairie soils occupy more than three-fourths of the area in this section of the state. Light-colored timber soils occur near the streams. Altho most of the surface soils have either a silt loam or clay loam texture, limited areas of sandy soils occur within and near Kankakee, Mason, Henderson, and Whiteside counties.

As is apparent from Table 1, many soil types occur on the farms that have been mapped, altho the number of types on a single farm is generally small. The types for which records of crop yields are available are described in Table 2. This table indicates how low or high each type is in organic matter, whether the areas are sloping or level, whether there is likely to be much erosion, how permeable to water the subsoil is, whether crops are likely to resist drouth, and how workable the soil is. Each of these characteristics is important to the operator or owner of a farm or to a prospective buyer.

The map on page 378 gives an idea of the location of the major soil regions. It also indicates the kind of "parent" material from which the soils of the different regions have been derived. Table 1 and the map together form a picture of the major soil conditions of central Illinois.

How Management Practices Alter Crop Yields

That each soil type varies greatly in productivity according to the kind of management given it is shown in Table 1. Hybrid-corn yields on Swygert silt loam and Bryce clay loam to clay, for example, were 71 percent higher under good management than under poor management.

Many different practices help to account for the yields which farmers are getting under good management. The ones which are given main consideration in this study, however, are cropping system and soil treatment. The kind of cropping system and soil treatment which a farmer uses are pretty good clues to his whole

Table 2.—CHARACTERISTICS OF SOIL TYPES IN CENTRAL ILLINOIS

(Only the types for which crop yields are available are listed)

Type No.	Type name	Region (see Fig. 1)[a]	Organic-matter content	Topography[b]	Susceptibility to erosion (erosion by water unless wind is indicated)[c]	Permeability of subsoil[d]	Resistance to drouth	Workability[e]
18	Clinton silt loam...........	1a, 1b, 1c	Low	Gently to moderately sloping	Moderate to great	Moderate	Fair	Fair to good
36	Tama silt loam............	1a, 1b, 1c	Medium	Moderately sloping	Moderate	Moderate	Fair to good	Good
41	Muscatine silt loam........	1a, 1b, 1c	Medium to high	Very gently to gently sloping	Slight	Moderate	Good	Good
43	Ipava silt loam............	1a, 1c	Medium to high	Very gently sloping	Slight to none	Moderate	Good	Good
46	Herrick silt loam..........	2a, 2b	Medium	Very gently sloping	Slight	Moderate to slow	Fair to good	Good
50	Herrick clay loam..........	2a, 2b	Medium to high	Nearly level	None	Moderate to slow	Good	Fair
59	Lisbon silt loam...........	8a, 8b	Medium to high	Very gently sloping	Slight to none	Moderate	Good	Good
65	Ipava silty clay............	1a, 1c	High	Nearly level	None	Moderate	Good	Fair to good
68	Sable silty clay............	1a, 1b, 1c	High	Nearly level	None	Moderate	Good	Fair to good
88	Hagener loamy sand........	10	Low	Very gently to gently sloping	Wind erosion	Rapid	Poor	Good
91	Swygert silt loam to silty clay loam..................	4	Medium to high	Gently sloping	Moderate	Slow	Fair	Good to fair
127	Harrison silt loam..........	2a, 2b	Medium to low	Gently sloping	Moderate	Moderate to slow	Fair	Good to fair
145	Saybrook silt loam.........	8a, 8b	Medium to high	Gently sloping	Slight to moderate	Moderate	Good to fair	Good
146	Elliott silt loam............	9	Medium to high	Gently sloping	Moderate to slight	Moderate to slow	Fair to good	Good
147	Clarence silt loam..........	3	Medium	Very gently to gently sloping	Moderate to great	Very slow	Fair to poor	Fair to good
148	Proctor silt loam...........	5	Medium	Gently sloping	Moderate to slight	Moderate	Fair	Good
149	Brenton silt loam..........	5	Medium to high	Very gently sloping	Slight to none	Moderate	Good	Good
152	Drummer clay loam........	5, 6, 8a, 8b	High	Nearly level	None	Moderate	Good	Fair to good
154	Flanagan silt loam.........	6	Medium to high	Very gently to gently sloping	Slight	Moderate	Good	Good

Table 2. — Concluded

Type No.	Type name	Region (see Fig. 1)[a]	Organic-matter content	Topography[b]	Susceptibility to erosion (erosion by water unless wind is indicated)[c]	Permeability of subsoil[d]	Resistance to drouth	Workability[e]
171	Catlin silt loam	6	Medium	Moderately sloping	Moderate	Moderate	Fair to good	Good
230	Rowe clay loam to clay	3	Medium to high	Nearly level	None	Very slow	Fair to good	Poor to fair
232	Ashkum clay loam to silty clay loam	9	High	Nearly level	None	Moderate to slow	Good	Fair
235	Bryce clay loam to clay	4	High	Nearly level	None	Slow	Good to fair	Fair
246	Bolivia silt loam	1a, 1c	Medium to high	Gently sloping	Slight to moderate	Moderate	Good	Good
247	Tovey silt loam	1a, 1c	Medium	Moderately sloping	Moderate	Moderate	Fair to good	Good
([f])	Brown Silt Loam developed from 40 to 65 inches of loess over calcareous (limey), slowly permeable, silty clay loam till[f]	7	Medium to high	Very gently to gently sloping	Slight to moderate	Moderate	Good	Good
([f])	Black Clay Loam developed from 40 to 65 inches of loess over calcareous (limey), slowly permeable, silty clay loam till[f]	7	High	Nearly level	None	Moderate	Good	Fair to good

[a] Location and extent and the parent material of each soil group region are indicated on Fig. 1, page 378.

[b] *Nearly level* means less than a 0.5-percent slope (½ foot in 100 feet); *very gently sloping* indicates a slope of 0.5 to 1.5 percent; *gently sloping*, 1.5 to 3.5 percent; *moderately sloping*, 3.5 to 7 percent.

[c] Degree of susceptibility to water erosion applies to soils *under cultivation*. Wind erosion is indicated where it is a hazard.

[d] Of the terms used, *moderate* expresses the most desirable condition.

[e] Workability is dependent upon the structure of the surface horizon, its texture and organic-matter content, as well as on slope and drainage.

[f] No official type number or name has yet been assigned to these two types.

program. If he rates "good" on these two points, he will probably be just as efficient in his other practices, such as time of plowing, method of seedbed preparation, rate of seeding, and choice of crop varieties. Similarly, if he ranks as "fair" or "poor" in his cropping system and soil treatment, it is to be expected that he will be "fair" or "poor" on other counts.

Therefore, cropping system and soil treatment have been used as the basis for defining three grades of management:

Good management. A rotation is used that keeps 20 to 30 percent of the cultivated land in legume hay or legume pasture or 33 percent in a legume catch crop which is plowed under as a green manure. Limestone has been applied to acid soils as needed, and phosphate to soils testing low in available phosphorus.[1]

Fair management. In each rotation period 10 to 20 percent of the cultivated land is in legume hay or legume pasture, or at least 20 percent is in a legume catch crop, which is plowed under as a green manure. Limestone has been applied as required on acid soils, especially if the rotation includes alfalfa or sweet clover.

Poor management. Less than 10 percent of the cultivated land in each rotation period is in a legume hay or legume pasture. Corn, soybeans, and small grains are the most important crops, and little or no soil treatment is applied.

More exact information on how farmers in the three groups have been managing their land is given in Table 1. Cropping systems used for the different soil types and soil associations are shown under "Percent of cultivated land in various crops." On the Flanagan silt loam and Drummer clay loam association, for example, the good farm managers planted 24 percent of the cultivated

[1] The specific practices that make up good management vary from one soil type to another. On some soils which are not known to be deficient in any nutrient but nitrogen, good management is easily achieved: a cropping system is used that includes plenty of legumes, and proper cultural practices are followed. On other soil types, good management is more complex: an adapted cropping system and proper cultural practices must be accompanied by fertilization and erosion control.

It is, as a rule, much more difficult and costly to apply good management practices to a naturally poor soil than to a naturally productive soil. This is an important point to remember when buying land, for if the land is to be worth anything the value of the crops produced must cover the cost of producing them and give a net return. Small differences in crop yields cause a large difference in net returns and a correspondingly large difference in land values.

land to legume hay or legume pasture crops. Under fair and poor management the percentages were only 13 and 7 respectively.

The extent of the limestone and rock-phosphate treatments is shown by the percentages in the last two columns of Table 1. Reference to Table 3 (which contains data from a representative tract of Clinton silt loam) will show how these percentages in Table 1 were calculated. The last two columns of Table 3 show what percentages of the tract had been treated with limestone and with rock phosphate up to and including each year of the study. By 1928, for example, 54 percent of this Clinton silt loam had been treated with limestone. By 1931 all the land had been limed. The "100 percent" for that year of course includes the "54 percent" which had been treated by 1928. The averages at the bottom of these columns are therefore averages of the *yearly cumulative percentages,* not averages of the final total coverage.

Table 3. — CALCULATING YIELDS AND SOIL TREATMENT: Illustrated by Records From a Tract of Clinton Silt Loam

Year	Yields per acre of corn and oats			Percent of cultivated land treated *yearly*		Percent of cultivated land treated *to date*	
	Hybrid corn	Open-pollinated corn	Oats	With limestone	With rock phosphate	With limestone	With rock phosphate
	bu.	*bu.*	*bu.*	*perct.*	*perct.*	*perct.*	*perct.*
1928	..	45	35	0	0	54[a]	0
1929	..	45	60	24	0	78	0
1930	..	30	31	0	0	78	0
1931	..	36	40	22	0	100	0
1932	..	62	..[b]	0	0	100	0
1933	..	26	29	0	0	100	0
1934	..	18	4	0	0	100	0
1935	..	60	24	0	0	100	0
1936	..	30	..[b]	0	0	100	0
1937	50	..	40	0	0	100	0
1938	70	..	42	0	18	100	18
1939	77	..	40	0	19	100	37
1940	48	..	57	0	11	100	48
1941	66	..	52	0	26	100	74
1942	65	..	50	0	12	100	86
1943	65	..	34	0	14	100	100
1944	66	..	44	26[c]	0	100	100
Total yields	507	352	582	..	..	...	..
Average yields	63.4	39.1	38.8	..	..	...	..
Total of yearly cumulative percentages						1610	463
Average of yearly cumulative percentages						94.7	27.2

[a] This is the percentage of the cultivated land that was treated with limestone before 1928, the year when farm records were first kept.

[b] Oats were not grown in 1932 and 1936.

[c] All cultivated land had been limed before 1944, so this was a second application on part of the tract.

The figures in the last two columns of Table 1 are likewise averages of the yearly cumulative percentages, but for groups of farms. Unless all the farms of a group had been *completely* treated with lime or with rock phosphate before or during the first year that records were kept, they would not be shown as *averaging* 100 percent. The fact is that on most farms in the good-management group all the acid soils have been limed for several years. Farms in the fair-management groups are just now being treated. This difference in the earliness at which liming has been done, as well as the extent to which it has been done, is reflected in the higher percentages for the farms under good management.

If the final total coverage in 1944 were used as a measure of good practice in applying soil amendments, some of the farms treated late would show up as well as those treated early. The percentages would therefore fail to show the superior management that has actually been applied to some of these farms over the entire period during which crop yields were studied.

A Yardstick for Central Illinois Farmers

Any farmer who is striving to achieve more efficient production needs first a measure that will show how good or how poor a job he is doing. Table 1 provides such a yardstick for central Illinois farmers. A farmer whose yields are below those reported for good management on the same type of soil as he is farming will probably find his management faulty at some point.

Even the yields shown for good management, however, are not the highest that can be obtained, or that were obtained. They show, for each soil type, what a number of farmers have been getting *as an average*. This means that some farmers in each group are getting higher yields. Take, for example, three of the 47 tracts located on an association of Muscatine silt loam and Sable silty clay. For the eight years 1937 thru 1944 these three tracts averaged 94, 91, and 90 bushels of hybrid corn an acre, respectively. One of the 13 well-managed tracts on an association of Saybrook silt loam, Lisbon silt loam, and Drummer clay loam averaged 90 bushels of hybrid corn to the acre during the same time. Ten other tracts on the better prairie soils averaged, under good management, from 85 to 89 bushels an acre. These ten tracts were located on the following soil types in the following regions:

Soil type No.	*Soil type name*	*Region on map*
36	Tama silt loam	1a, 1b, 1c
41	Muscatine silt loam	1a, 1b, 1c
43	Ipava silt loam	1a, 1c
59	Lisbon silt loam	8a, 8b
65	Ipava silty clay	1a, 1c
68	Sable silty clay	1a, 1b, 1c
145	Saybrook silt loam	8a, 8b
152	Drummer clay loam	5, 6, 8a, 8b
154	Flanagan silt loam	6
246	Bolivia silt loam	1a, 1c

Crop yields obtained on four of the University of Illinois soil experiment fields (Table 4) also show how much production can be increased on some of the central Illinois soils. These fields are located on soils of high, medium, and low productivity. The yields are from plots treated with crop residues, limestone, rock phosphate, and potash, indicated as RLPK for short. A good crop rotation is used on each field.

Most of the yields reported in Table 4 are significantly higher than those which farmers have been getting on similar soils (Table 1). An exception is the yield of open-pollinated corn on associations of Swygert silt loam to silty clay loam and Bryce clay

Table 4.—CROP YIELDS OBTAINED ON DIFFERENT SOIL TYPES UNDER SUPERIOR MANAGEMENT[a]: Four Soil Experiment Fields in Central Illinois

(1925 to 1944 inclusive)

Field	Soil type or types	Type No.	Average yield per acre: Hybrid corn 1937-1944	Open-pollinated corn 1925-1936	Oats 1925-1944
			bu.	*bu.*	*bu.*
Kewanee	Muscatine silt loam and Sable silty clay associated	41-68	99.1	73.3	58.2
Carlinville	Herrick silt loam	46	88.6	43.4	55.1
Joliet	Swygert silt loam to silty clay loam and Bryce clay loam to clay associated	91-235	71.4	40.5	59.2
Oquawka	Hagener loamy sand	88	61.6	38.3	14.9[b]

[a] Plots were treated with RLPK: that is, with crop residues (R), limestone (L), rock phosphate (P), and potash (K). A good crop rotation is used on each field.

[b] Wheat was grown on the Oquawka field instead of oats. Oats are not included in the rotation.

loam to clay. Farmers who practiced good management got practically the same yields as those obtained on the experiment field at Joliet. Oat yields on the farms, however, were only 66 percent as high as those on the experimental plot. Hybrid corn yields were 84 percent as high as the Joliet yields.

On associations of Muscatine silt loam and Sable silty clay, yields obtained by farmers who used good management also fell short of the experimental results. Yields of open-pollinated corn, hybrid corn, and oats were only 72, 76, and 81 percent as high on the farmers' fields as on the Kewanee experiment field.

Farmers' yields of oats and hybrid corn on soil associations that included Herrick silt loam were, even under good management, considerably below yields on the Carlinville plots. Altho no figures are available in Table 1 to show results under good management on Hagener loamy sand, the difference in hybrid-corn yields under fair management on farms and under best management on the Oquawka experiment field are also of considerable interest.

A number of things help to explain why farmers' yields thus far have usually been lower than those on the University's soil experiment fields:

1. Most farmers who have adopted good management practices have done so only within the last 10 or 20 years, while the RLPK plots have been in continuous operation for 30 to 35 years. Many farmers have not practiced good soil management long enough to obtain maximum yields.

2. Since farm fields are much larger than the experimental plots, soil conditions are often more variable. It is therefore harder to be timely in field operations.

3. Harvesting losses are greater on farmers' fields than on the soil experiment fields.

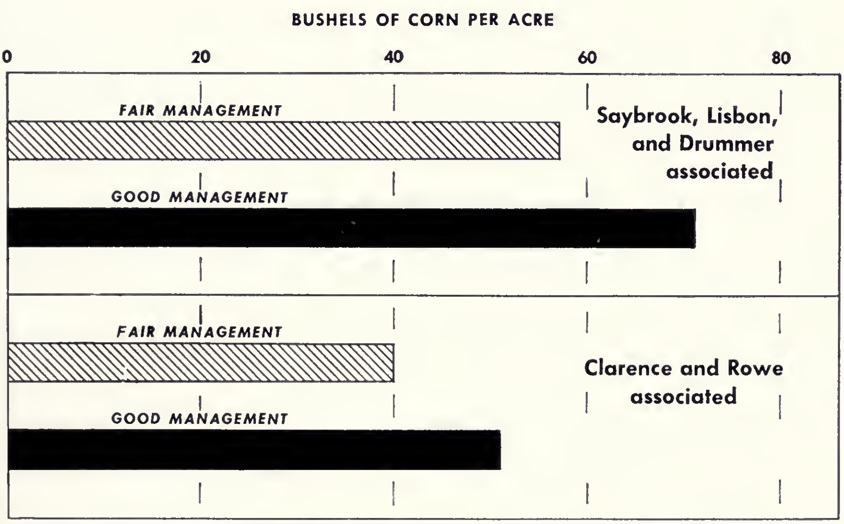
Yields reported in Table 1 for good management were produced primarily under a legume - limestone - rock-phosphate system of management. Soil investigations show that more intensive fertilization greatly increases the yields of some crops. Production of wheat and corn, for example, can be increased by the use of soluble fertilizers under proper conditions.

Achieving Efficient Production on Your Farm

The figures just given show what can be done. The next thing to know is how to do it. Briefly, these are the basic steps in a good soil-improvement program:

1. **Get all the information you can about each soil type on your farm.** Know all its characteristics. Only then can you use the land in the most effective way. Do not be content with 50 bushels of corn to the acre on a field that will produce 75 bushels. On the other hand, money and effort can be wasted in an attempt to get higher yields from a soil than it is capable of producing. It may be that the subsoil is heavy, or that the soil is drouthy, or that there is some other characteristic that cannot be corrected without too much money or labor.

The effects of differences in soil and in management on yields



Hybrid corn yields on two groups of farms in the northern part of central Illinois show what good management will do on some soils in that part of the state. While the better practices gave worth-while increases on an association of Clarence silt loam and Rowe clay loam to clay (Region 3, Fig. 1), yields were not so high as on the association of Saybrook silt loam, Lisbon silt loam, and Drummer clay loam (8b on map). Reason for the lower productivity of the Clarence-Rowe association is a heavy clay subsoil. Figures are averages for the years 1937 thru 1944. (Fig. 2)

of hybrid corn are illustrated in Fig. 2. On one group of farms the soils consisted of an association of Saybrook silt loam, Lisbon silt loam, and Drummer clay loam. On another group the soils were a mixture of Clarence silt loam and Rowe clay loam. Good management, compared with fair management, increased the yields on the first group of farms from 57 to 71 bushels an acre. It increased the yields on the second group of farms from 40 to 51 bushels. (These figures are averages for eight years, 1937 thru 1944.) Altho both groups of soils responded to good management, it is clear that the second group has a lower limit to its yields than the first group. The fact is that Clarence silt loam and Rowe clay loam have a clay subsoil which is nearly impermeable to water and air and which the roots of crops can scarcely penetrate. This is the main difference between these soils and the Saybrook-Lisbon-Drummer soils. All are dark prairie soils and all occur on nearly level to gently sloping topography.

2. Keep farm records each year. Good records are the only sure basis for comparing your crop yields with what others get on similar soils. People who do not keep yearly records are likely to remember the high yields in favorable years or on some especially good field and to forget the lower yields in other years or on other fields. Nothing less than a five-year average will give a figure worth comparing with the twenty-year averages in Table 1. Weather, for one thing, varies too much from year to year.

3. Examine your management practices. If your yields are below those that other farmers are getting from the same soil type, find the reason. Test your soils to see whether they are acid or low in available phosphorus and potassium. Check your cropping systems — ask yourself whether they will support high yields over a long period without harming your soils. Are you using the best cultural practices — time of plowing, method of seedbed preparation, rate of seeding — and the best crop varieties?

4. Make necessary changes. Merely finding out what is holding down crop yields won't increase them. The next step, therefore, is to translate this information into action — to make out a definite crop- and soil-management plan on the basis of your findings and put it into operation.

There is no regular order in which changes should be made, for conditions vary from one farm to another. Usually, improved cultural practices should be adopted first since they take very little time or money in relation to the yield increases which they produce.

The adoption of a good rotation, including the proper kinds and acreage of deep-rooted legumes, requires a sweet soil. It is therefore necessary to apply limestone on acid soils before it is practical to make changes in the cropping system. Correcting phosphorus and potassium deficiencies is normally the next step in improving crop yields. The kind, amount, and method of applying these fertilizers will depend on the soil tests, cropping system, and the amount of money available for soil treatment. Your farm adviser will be glad to help you plan the best crop- and soil-management system for your farm.

There is good reason to believe that farmers can look forward to getting higher yields in the future than they have obtained to date. Increased yields will, however, require the skilful combining of improved crop varieties with better cultural practices and better soil management than most farmers have applied in the past.

SUMMARY

Most farm lands of central Illinois are productive when well managed. They consist of many different soil types, of which the most common are described in this bulletin. The types which have been studied are located in 10 major soil regions, a region consisting of an area with the same underlying "parent" materials.

Long-time records kept by farmers in central Illinois show how much crop yields differ from one soil type to another. These records show too the extent to which poor or fair crop yields can be increased by better farm practices. The records analyzed in this study cover 444 different tracts (farms or parts of farms with uniform soil and management) and extend over periods ranging from ten to twenty years. Yields from four of the University's soil experiment fields show still further possibilities in some of these soils.

The information in this bulletin will enable many farmers in central Illinois to measure the efficiency of their production practices. Those whose yields are below the best will find suggestions for bringing them up to a more profitable level.

The question **HOW PRODUCTIVE ARE THE SOILS OF CENTRAL ILLINOIS?** is answered in this bulletin by showing what crop yields farmers themselves are getting from the most important soil types in this area. Carefully kept records demonstrate what can be expected under good management as contrasted with fair management and poor management.

Any farmer whose yields do not come up to the best shown for his soil type is probably not realizing the full possibilities in his farm. He will find it worth while to review his production practices and plan a definite program of improvement.

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